



Using the basic reproduction number to assess the effects of climate change in the risk of Chagas disease transmission in Colombia

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Abstract:

The dynamics of vector-borne diseases has often been linked to climate change. However the commonly complex dynamics of vector-borne diseases make it very difficult to predict risk based on vector or host distributions. The basic reproduction number (R_0) integrates all factors that determine whether a pathogen can establish or not. To obtain R_0 for complex vector-borne diseases one can use the next-generation matrix (NGM) approach. We used the NGM to compute R_0 for Chagas disease in Colombia incorporating the effect of temperature in some of the transmission routes of *Trypanosoma cruzi*. We used R_0 to generate a risk map of present conditions and a forecast risk map at 20 years from now based on mean annual temperature (data obtained from Worldclim). In addition we used the model to compute elasticity and sensitivity indexes on all model parameters and routes of transmission. We present this work as an approach to indicate which transmission pathways are more critical for disease transmission but acknowledge the fact that results and projections strongly depend on better knowledge of entomological parameters and transmission routes. We concluded that the highest contribution to R_0 comes from transmission of the parasites from humans to vectors, which is a surprising result. In addition, parameters related to contacts between human and vectors and the efficiency of parasite transmission between them also show a prominent effect on R_0 .

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Resource Description

Climate Scenario :

specification of climate scenario (set of assumptions about future states related to climate)

Other Climate Scenario

Other Climate Scenario: unspecified SRES scenario

Early Warning System:

resource focus on systems used to warn populations of high temperatures, extreme weather, or other elements of climate change to prevent harm to health

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Exposure :

Climate Change and Human Health Literature Portal

weather or climate related pathway by which climate change affects health

Ecosystem Changes, Temperature

Temperature: Fluctuations

Geographic Feature: 

resource focuses on specific type of geography

Tropical

Geographic Location: 

resource focuses on specific location

Non-United States

Non-United States: Central/South America

Health Impact: 

specification of health effect or disease related to climate change exposure

Infectious Disease

Infectious Disease: Vectorborne Disease

Vectorborne Disease: Fly-borne Disease

Fly-borne Disease: Trypanosomiasis

Mitigation/Adaptation: 

mitigation or adaptation strategy is a focus of resource

Adaptation

Model/Methodology: 

type of model used or methodology development is a focus of resource

Exposure Change Prediction

Resource Type: 

format or standard characteristic of resource

Research Article

Timescale: 

time period studied

Medium-Term (10-50 years)

Vulnerability/Impact Assessment: 

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

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